REMARKS

By the present amendment, claims 1, 3 and 28 to 43 are pending in the application.

Support For Claim

Support for the new and amended claims is as follows.

Claims 1

Amended independent claim 1 corresponds to a combination of original claims 1 and 2.

Claim 3

Dependent claim 3 has been amended to be dependent on amended claim 1.

Claim 28

New independent claim 28 is a combination of prior claims 1 and 4.

Claim 29

New dependent claim 29 corresponds to prior dependent claim 5.

Claim 30

New independent claim 30 is a combination of prior independent claim 7 and dependent claim 16.

Claim 31

New dependent claim 31 corresponds to prior dependent claim 17.

Claim 32

New independent claim 32 corresponds to prior independent claim 7 and dependent claim 18.

Claim 33

New dependent claim 33 corresponds to prior dependent claim 19.

Claims 34 & 35

New dependent claims 34 and 35 correspond to prior dependent claims 8 and 9.

Claims 36 - 43

New dependent claims 36-43 correspond to prior dependent claims 20-27.

New matter is not being presented by the present amendment.

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claims 1, 7-9 and 20-25 were finally rejected in the Office Action mailed November 14, 2002 as being unpatentable over European Patent No. 46606 (EP '606).

Claims 2-5 and 16-19 were finally rejected in the Office Action mailed November 14, 2002 as being unpatentable over European Patent No. 46606 (EP '606) in view of either U.S. Patent No. 4,859,415 to Shida et al. (USP '415) or U.S. Patent No. 5,226,981 to Meredith et al. (USP '981).

These rejections as applied to the new and amended claims of the present amendment, are respectfully traversed.

Patentability

By the present amendment, in order to further distinguish the claims over the cited references, the subject matter of the claims has been restricted to ∝ + β dual phase alloys of the Ti-3.5Al-2V series or Ti-6Al-4V series.

Item 2 of Office Action

The Office Action takes the position that EP '606 discloses that a tube is produced by cold forming and welding or other methods.

However, as discussed in the previous response, EP '606 does not relate to an α+β dual phase titanium alloy having a high strength and low ductility (low cold formability).

The technology of EP '606 can be only satisfactorily applied to a soft titanium alloy having an α phase as a main phase but cannot be satisfactorily applied to the present inventive α+β dual phase titanium alloy having a high strength and low ductility (low cold formabiity), particularly to a strip having a thickness of 6 mm or more causing extreme difficulty in pipe production.

EP '606 only discloses titanium alloys having an α phase as a main phase. It is well known that α phase titanium alloys as disclosed in EP '606 can be satisfactorily formed to a good-shaped pipe but do not have a tensile strength of 600 MPa or more.

As described in the present specification, Samples No. 60, 61 and 62 of a high strength have a low ductility causing an overall estimation of "**X**" meaning "poor formability". This shows that irrespective of alloy types, high strength titanium alloys cannot provide a material satisfactorily applicable to a cold forming and welding process to produce a pipe with good properties.

The Office Action states that the ratio of the minimum to maximum wall thickness of 0.95 to 0.99 can be obtained by a person with ordinary skill in the art.

However, this is only valid for soft materials having good cold formability. High strength $\alpha+\beta$ dual phase titanium alloys, having a tensile strength of 600 MPa or more, have a poor cold formability and are very difficult to be formed with a ratio of the minimum to maximum wall thickness of 0.95 to 0.99.

Item 4(a) of Office Action

The Office Action takes the position that the basis is unclear in our assertion that the material in EP '606 is an α phase material.

However, EP '606, page 3, line 32 discloses that its alloy contains Ti_2Co and Ti_2Ni precipitates. If a β phase is present in the alloy, such precipitates do not form. This can be clearly seen from phase diagrams of the Ti-Co and Ti-Ni systems, copies of which are attached hereto in attached

Phase Diagrams of Binney Titanium Alloys, ASM, 1987, pp 59-60 and pp 197-198.

The Office Action also stated that EP '606 describes hot rolling at temperatures above β-transus, which causes formation of an α+β dual phase structure.

However, the phase diagrams clearly show that although an early state of cooling process includes passing through an α+β region, a further stage of cooling to room temperature includes passing through an α single phase region or a dual phase region of α + Ti_2Co or Ti_2Ni, with the result that the β phase once formed during the early stage of cooling process will substantially diminish, so that the amount of a β phase, if any, in the alloy structure thus formed will be too small to refer the alloy as having "an α+β dual phase".

Items 3 & 4(b) of Office Action

It is true that USP 4,859,415 and USP 5,226,981 refer to a seam welded pipe of a high strength α+β titanium alloy, although they substantially relate to an alloy containing elements of the platinum group, which has no direct relationship to a single seam welded pipe of an α+β titanium alloy of the present invention.

However, both USP '415 and USP '981 suggest nothing about production of a high strength α+β titanium alloy pipe for which it is difficult to provide dimensional precision by

using special cold forming techniques, i.e., press bending and a U-O method, as in the present invention.

The seam welded pipes disclosed in USP '415 and USP '981 should be recognized as being produced by any of the conventional methods described in the Background Art section of the present specification, i.e., page 1, line 10 to page 2, line 37. Namely, these pipes are reasonably considered to be produced through hot forming or to be pipes having a thin wall.

The present invention is based on the object to provide an alternative solution enabling a high strength $\alpha+\beta$ titanium alloy pipe having a thick wall (6 mm or more) to be produced without hot working.

As discussed above, the present invention relates to a high strength $\alpha+\beta$ titanium alloy pipe having a wall thickness of 6 mm or more, which is extremely difficult to cold form because of both the high strength and the thick wall. The present invention is based on the new finding that a long pipe of such a poorly formable material is only cold formable by press bending or a U-O method among numbers of cold forming methods. The cited references suggest nothing about this feature of the present invention.

Summary

It is therefore submitted that amended independent claim 1 and new independent claims 28, 30 and 32, and all claims dependent thereon, are patentable over European Patent No. 46606 standing alone or in combination with U.S. Patent No. 4,859,415 to Shida et al. or U.S. Patent No. 5,226,981 to Meredith et al.

CONCLUSION

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the present amendment be entered and the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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